LANDFORMS

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PREPARED TO MEET SOUTH CAROLINA'S NEW SCIENCE STANDARDS

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DESTRUCTIVE (EROSIONAL) LANDFORMS

Erosional landforms result from the removal of weathered and eroded surface materials by wind, water, glaciers and gravity. This includes landforms with some of the following geomorphic features- river valleys, glacial valleys, and coastal cliffs.

EROSION

Erosion is the removal and transportation of weathered or unweathered materials by water, wind, ice and gravity.

EROSIONAL AGENTS

- Water
- Wind
- Ice
- Gravity

WEATHERING

Weathering is the disintegration and decomposition of rock at or near the earth’s surface.

TYPES OF WEATHERING

Mechanical weathering: A breakdown in the size, but not the composition, of solid materials.

Chemical weathering: The process by which rocks are decomposed, dissolved or loosened by chemical processes to form residual materials.

Biological weathering: The disintegration of rocks and minerals due to the chemical and/or physical agents of organisms.

PROCESSES OF MECHANICAL WEATHERING

1) Pressure release: Fracturing (exfoliation) produce sheets.
2) Frost wedging: Produces angular blocks and talus from repeated freezing and thawing.
3) Abrasion: Produces smaller grains as rocks bump and grind against one another.
4) Organic activity: Roots break up rocks and soil, and earthworms and termites make tunnels in the ground.

PROCESSES OF CHEMICAL WEATHERING

- Carbonation is the process by which carbon dioxide in rainwater or moisture in the surrounding air forms carbonic acid that reacts with minerals in the rock. This process weakens the rock, thus facilitating its breakdown.
- Hydrolysis is the chemical reaction between minerals in the rock and hydrogen in the rainwater.
- Oxidation is the process by which oxygen combines with water and minerals in the rock.
- Solution is the process by which minerals in the rock dissolve directly in water.
- Hydration is the process where in minerals in the rock absorb water and expand, creating stress which causes the disintegration of the rock.

CONSTRUCTIVE LANDFORMS

- Tectonic landforms are created by massive earth movements due to plate tectonics. This includes landforms with some of the following geomorphic features: fold mountains - rift valleys, and volcanoes.
- Depositional landforms are produced from the deposition of weathered and eroded surface materials. On occasion, these deposits can be compressed and altered by pressure, heat and chemical processes to become sedimentary rocks. This includes landforms with some of the following geomorphic features - beaches, barrier islands, spits, deltas, flood plains and glacial moraines.

GLACIAL LANDFORMS

DESTRUCTIVE (EROSIONAL) GLACIAL LANDFORMS

- Glacial valleys
- Arêtes
- Horns
- Cirques
- Cols
- Hanging valleys
- Striations

MECHANISMS OF GLACIAL EROSION

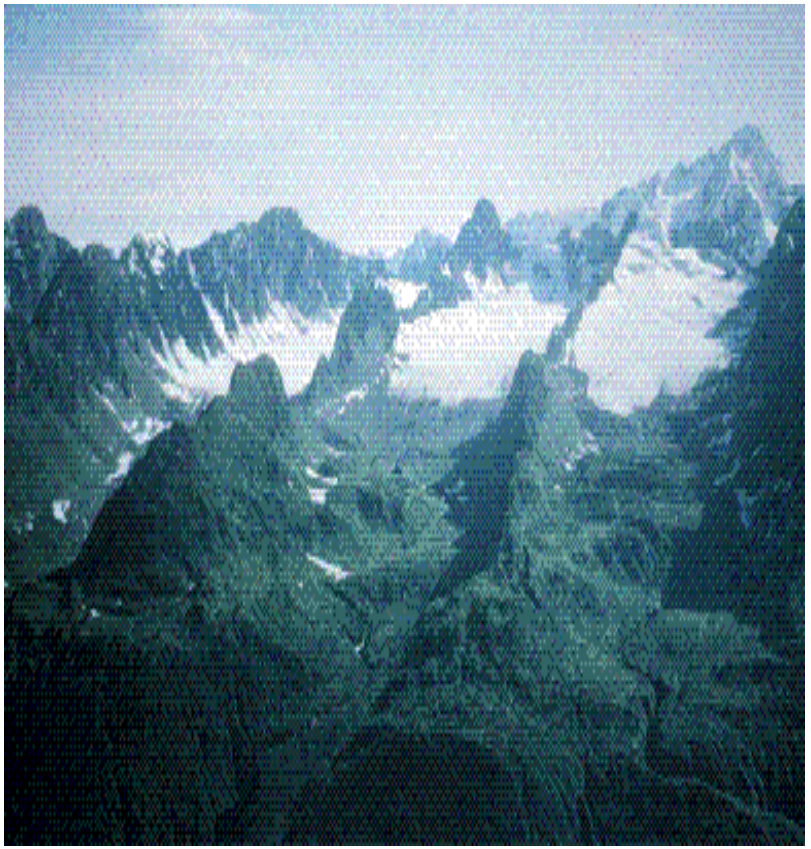
- Abrasion: Debris in the ice scrapes away part of the underlying rocks.
- Plucking: The removal of large blocks by an overriding glacier.

GLACIAL VALLEYS

- Glacial valley: a U-shaped valley that results from glacial action. In addition, glaciated valleys include steep vertical cliffs where glacial erosion has actually sheared away entire mountainsides.

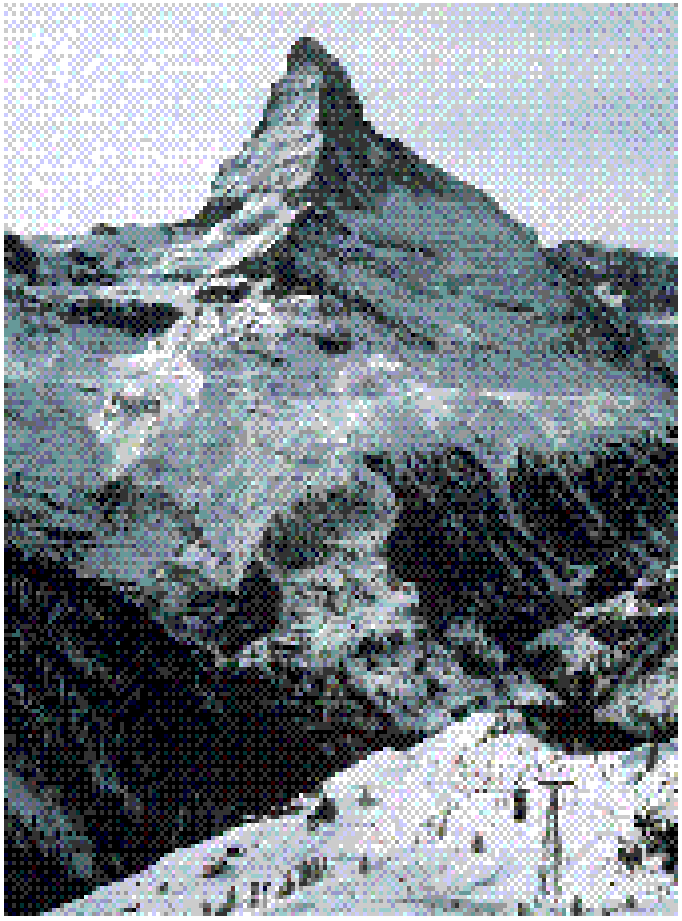
ARÊTES

- Arête (French for knife-edge): a jagged, narrow ridge created when the back walls of two glaciers meet. They also can be formed when the divide between glaciers that occupy adjacent valleys narrows.



HORN

- Horn: created in much the same way as an arête. Several glaciers erode a mountain until all that is left is a steep, pointed peak with sharp, ridge-like arêtes leading up to the top. A classic example is the Matterhorn in Switzerland.

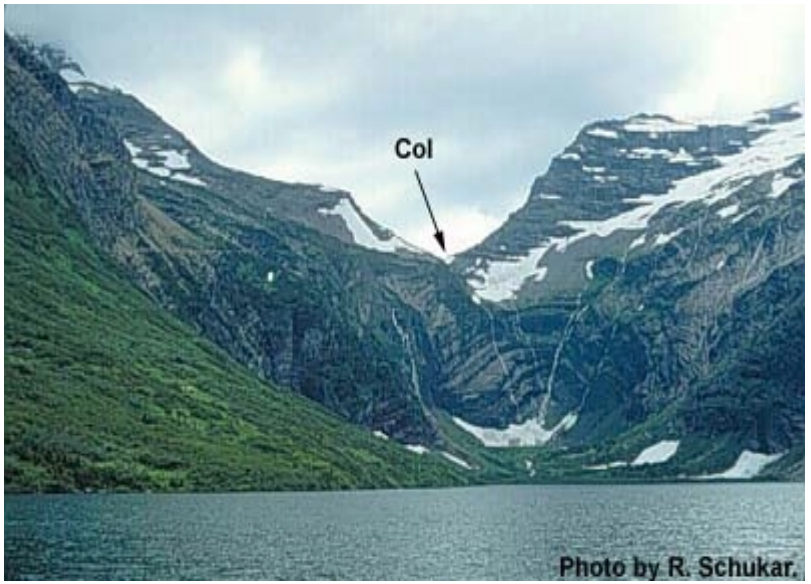


CIRQUE

- Cirque: a semicircular or amphitheater-shaped bedrock feature created as a glacier cuts back into the mountain where the snow and ice forming the glacier first accumulates.

COL

- Col: a low spot or pass along a cirque or arête.



HANGING VALLEY

- Hanging valley: a valley eroded by a small tributary glacier, such that the valley floor is higher in elevation than the valley floor of the larger glacier.

STRIATIONS

- These striations or grooves were formed as individual particles carried at the base of a glacier moved across the bedrock and scratched the rock. The striations provide important clues to the direction of ice flow, especially important if we were not around to observe the glacier when it existed. In this case, the glacier flowed from the bottom right to the upper left of the photo. Striations can result from alpine or continental glaciations.

CONSTRUCTIVE (DEPOSITIONAL) GLACIAL LANDFORMS

- Moraines
- Eskers
- Drumlins
- Outwash plain

MORAINES

- Moraine: An accumulation of unconsolidated material deposited by glaciers. These accumulations tend to be unsorted that is, we find many different sizes of particles deposited in moraines, ranging from silt to large boulders. The sediment and rock material in moraines also tend to have angular edges, enabling geologists to distinguish them from stream deposits that are normally more rounded. There are many different types of moraines and, depending on the type, the appearance of moraines may vary.

END MORAINE

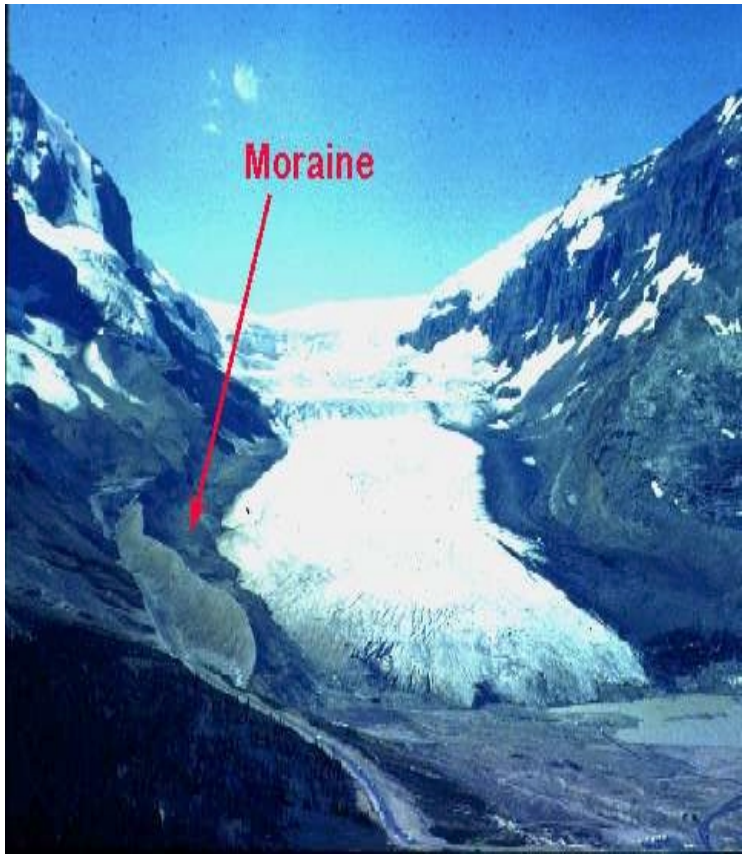
- End moraine: An accumulation of unconsolidated material deposited at the front end of a glacier. Two types of end moraines are terminal moraines and recessional moraines. The terminal moraine marks the farthest extent of glacial advance and thus is the end moraine located at the lowermost elevation. Recessional moraines form as glaciers pause during periods of retreat and, thus, are located at higher elevations than terminal moraines. After glaciers retreat, both types of end moraines may be altered or destroyed by fluvial erosion

GROUND MORAINE

- Ground moraine: Unconsolidated material deposited directly beneath the base of a glacier. All the rock debris shown in the foreground of this photo constitutes ground moraine. The material was formerly beneath Grinnell Glacier, Glacier National Park, Montana. Debris in moraines ranges in size from fine silt, which we cannot see in this photo, to large boulders; thus, moraine deposits are unsorted.

LATERAL MORAINE

- Lateral moraine: Unconsolidated material deposited along the sides of alpine glaciers. Lateral moraines may form on top of existing alpine glaciers along the sides of the valley walls. Freeze-thaw weathering results in debris falling on top of the glacial ice, forming a ridge. As glaciers melt, this material may be deposited on the landscape as a ridge.



MEDIAL MORAINE

- Medial moraine: Moraine formed on top of existing glaciers when two alpine glaciers flow together. When this happens, their lateral moraines join to form a medial moraine, a ridge in the middle and on top of the glacier.

ESKER

- Esker: A sinuous (snakelike) ridge of gravel deposited in a tunnel beneath a glacier.

DRUMLIN

- A streamlined asymmetrical hill composed of glacial sediment (till). The steep side of the hill faces the direction from which the ice advanced.

KETTLE

- Kettle: A depression in an outwash plain formed by block ice. These lake-filled kettles in central Chile were formed when debris covered ice melted away.

OUTWASH PLAIN

- Outwash plain: A flat rolling plain formed ahead of the glacier by meltwater from the glacier.

TECTONIC LANDFORMS

- Tectonic landformsare created by massive earth movements due to plate tectonics. This includes landforms with some of the following geomorphic features - fold mountains, rift valleys, and volcanoes.

TECTONIC LANDFORMS

- Cinder cones
- Shield volcanoes
- Stratovolcanors
- Lava domes
- Faults
- Folds

VOLCANIC LANDFORMS

CINDER CONES

- Cinder cone (scoria cone): Cinders are erupted from a central vent. Loose cinders form a cone-shaped pile around the vent. Cinders form from bursting bubbles of gas in the magma that eject lava into the air. Lava flows are commonly associated with cinder cones. Cinder cones can be found on shield and stratovolcanoes and at divergent and convergent plate boundaries and hot spots.

SHIELD VOLCANOES

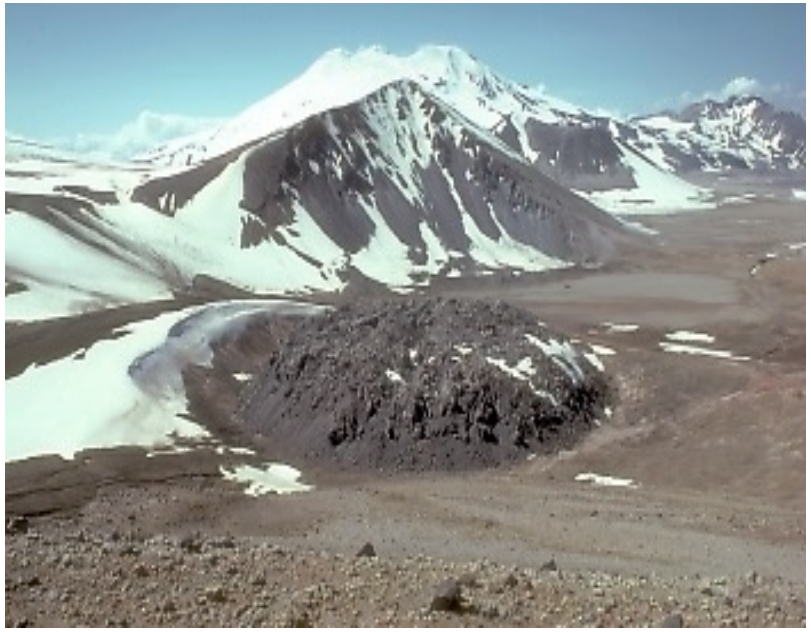
- Shield volcano: a volcano built from lava flows. Shallow slopes with relatively flat tops that look like a shield lying on the ground. They are the largest volcanoes in the Earth and Solar System.

STRATOVOLCANOES

- Stratovolcano also called composite cone: Composed of lava flows and pyroclastic (ash) deposits Eruptions are violent due to gas content and high-viscosity (resistance to flow) magma. Ash deposits can be extensive.

LAVA DOME

- Lava domes: rounded, steep-sided mounds built by very viscous magma. Such magmas are typically too viscous (resistant to flow) to move far from the vent before cooling and crystallizing. Domes may consist of one or more individual lava flows.



OTHER TECTONIC LANDFORMS

FAULT SCARPS

- Formed from earth movement. They may be related to plate tectonic activity like the San Andreas fault, a transform boundary.

RIFT VALLEYS

- A down faulted structure (normal or regular fault).

FOLDS

- A bent layer or series of layers that were originally horizontal. May form mountains.

FLUVIAL LANDFORMS

- Landforms formed by the action of rivers.

DEPOSITIONAL FLUVIAL LANDFORMS

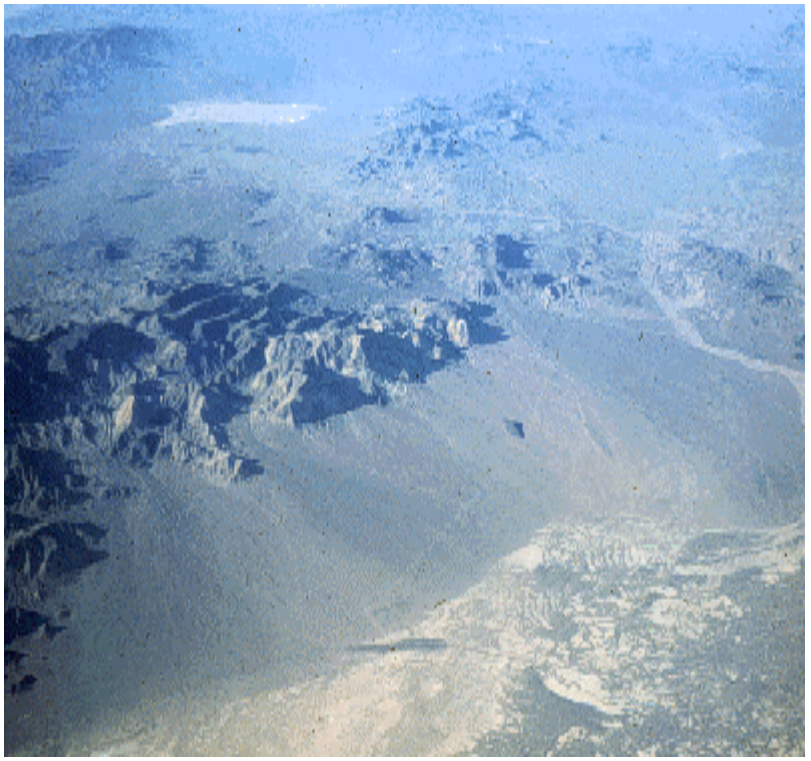
- Alluvial fan
- Bajada
- Playa
- Playa lake
- Levee
- Meander
- Delta

ALLUVIAL FAN

- A fan-shaped deposit of sediment formed when a stream slope is abruptly reduced.

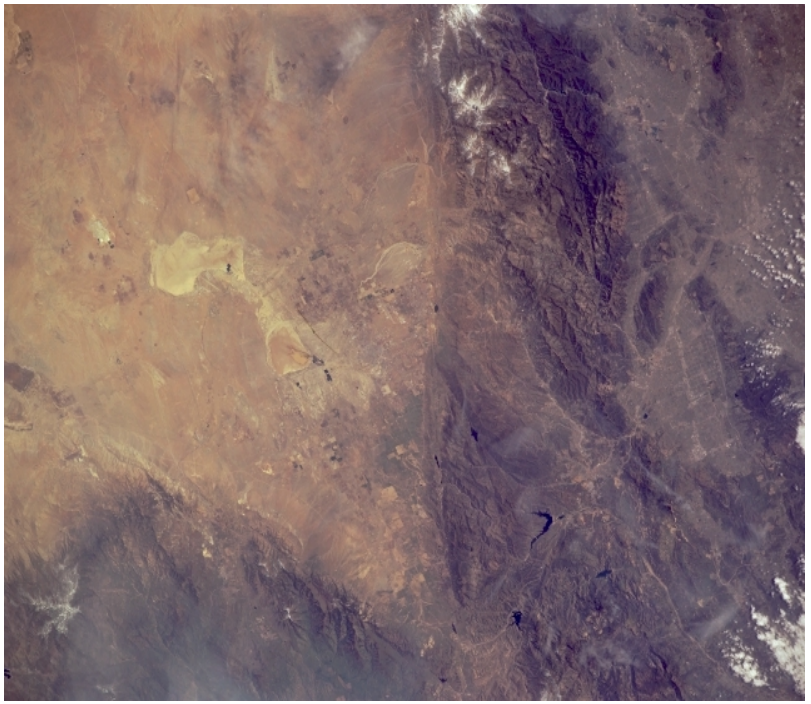
BAJADA

- A broad slope of debris spread at the base of mountains by descending streams, usually found in arid or semiarid climates. A bajada is often formed by the coalescing of several alluvial fans.



PLAYA

- A dry, flat lake bed. Aerial view of the San Andreas fault with dry lake beds (playas are white areas).



PLAYA LAKE

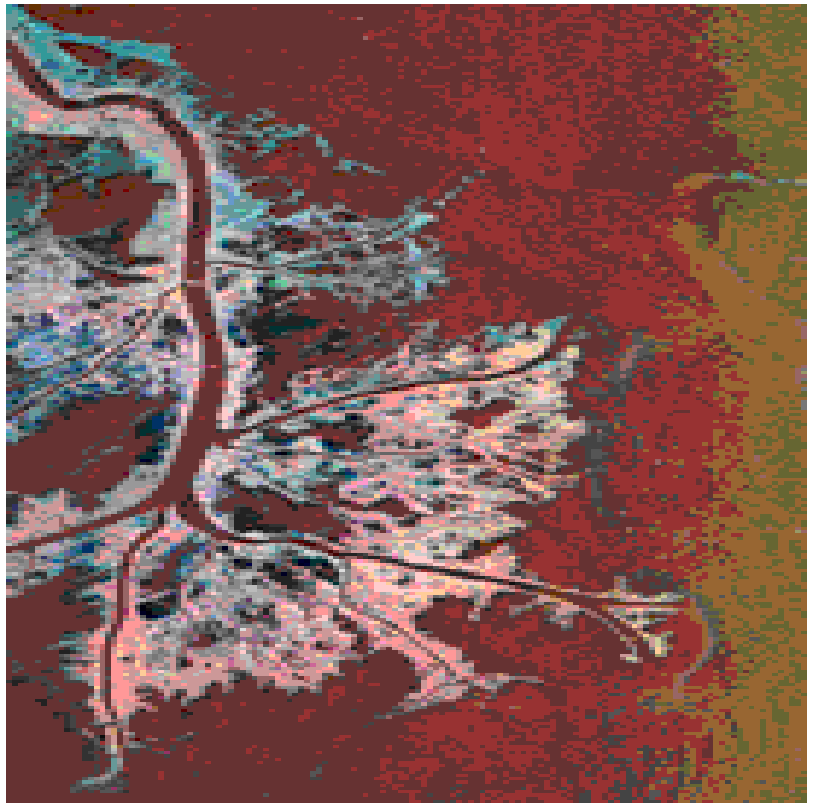
- During abundant rainfall or snowmelt in the mountains, streams may flow across alluvial fans and convert the basin floor into a lake.

LEVEE

- A deposit of sand and silt that parallels the course of a river. This deposit is formed by floods.

DELTA

- Delta: the low, nearly flat tract of land deposited at or near the mouth of a river.
- For example: Mississippi River bird's-foot delta. Bird's foot is the common name reflecting many small channels flowing across the top of a delta



EROSIONAL FLUVIAL LANDFORMS

- Meander
- V-shaped valley

MEANDER

- Meander: A loop-like bend in the course of a stream formed by slow- moving water and a lower stream gradient.

STREAM VALLEY

- A V-shape formed by the erosion of a stream.

EOLIAN LANDFORMS

- Landforms resulting from by wind action.

EROSIONAL EOLIAN LANDFORMS

TYPES OF WIND EROSION

- Deflation - removal of finer-grained loose and dry sediment by wind.
- Abrasion - removal of material by impacting particles

DESERT PAVEMENT

- Over thousands of years, deflation removes the finer grained particles and the gravel (coarser grained material) is left behind as desert pavement.

VENTIFACTS

- Ventifacts have at least one smooth, abraded surface facing upwind. These ventifacts litter the ground near Lake Vida in Victoria Valley, Antarctica.

YARDANGS

- Yardangs are streamlined parallel ridges aligned with the prevailing wind direction.

EOLION DEPOSITIONAL LANDFORMS

- Ripples
- Dunes
- Loess

EOLIAN SEDIMENT TRANSPORT

Suspension: Air suspends particles less than 0.2 mm in diameter this dust is carried thousands of meters upward and 1,000 kms downwind, held in suspension by turbulent eddies.

Saltation: Transport of sand grains in long, low trajectories as momentum is passed from grain to grain. Grains are momentarily suspended but are too heavy to remain in suspension. Grains transported by this process travel 4 times longer in distance than in height.

Creep: Movement of coarse sand and pebbles (up to 6x larger in diameter than saltating grains) as they slide and roll impacting one another and transferring momentum

WIND DEPOSTION

- Dust and sand are deposited if the winds lose their velocity, obstructions create wind shadows, or the particles moving by saltation strike a softer surface and lose energy.

RIPPLES

- Small sand waves with a wavelength of about 1 mm. They move, disappear and reform during windstorms and are common on the windward slopes of sand dunes.

DUNES

- Barchan dune is a crescent-shaped sand dune with the horns pointing downwind.

LOESS

- Loess is an unstratified windblown silt deposit that forms vertical cliffs and fertile soil.

COASTAL LANDFORMS

COASTAL DEPOSITIONAL LANDFORMS

- Beach
- Barrier island
- Spit

BEACH

- Beach: an exposed deposit of lose sediment at the transition zone between land and water

BARRIER ISLAND

- Barrier island: a long, narrow offshore ridge of sand parallel to the mainland shore

SPIT

- Spit: an elongated strip of sand extending into the water but attached at one end to the mainland.

COASTAL EROSIONAL LANDFORMS

SEA CLIFF

- Sea cliff: an area of steep rock faces where waves eroded the bottom of the cliff and undercutting of the cliff caused the cliff face to calve off or retreat.

OTHER EROSIONAL LANDFORMS

- Inselberg
- Butte

INSELBERG

- An isolated hill that stands above a well-developed plain and appears as an island rising from the sea.

BUTTE

- Usually an isolated flat-topped mountain.

IMPACT CRATERS

- A crater formed by the impact of a meteor or other extraterrestrial object. Meteor Crater, Arizona

WEATHERING LAND FORMS

- Karst
- Sinkhole

KARST

- Karst is a distinctive topography in which the landscape is strongly influenced by the dissolving action of water on carbonate bedrock (usually limestone, dolomite or marble).

SINKHOLE

- A topographic depression formed as underlying limestone bedrock is dissolved by ground water. It is considered the most fundamental structure of karst topography.